15. ACCUMULATION OF LEAD, ZINC AND CADMIUM IN THE NESTLING FEATHERS OF HOOPOE *UPUPA EPOPS*

Introduction

Accumulation of heavy metals in the body due to metal pollutants in food, water or air has been considered to be dangerous for the reproduction and survival of birds (Leonizo *et al.* 1986).

Due to the growing industrial activity and motor traffic, the environment is being contaminated by heavy metals. The input of lead into the environment has increased during the last two decades especially with the development of lead-containing gasolins, the consumption of storage batteries and the manufacture of lead components. The major source of airborne cadmium pollution are emissions from steel industries, waste incineration, zinc production and some agricultural practices. Monitoring of atmospheric pollution is of great importance. Bird feathers and mammalian hair, because they accumulate various metals from the environment and from food, have attracted attention for the last decade as indicators of these pollutants (Doi *et al.* 1986).

The Hoopoe (*Upupa epops*) has been declared the Punjab state bird. I have observed personally that the number of Hoopoes has decreased in recent times. This study on lead, zinc and cadmium load in the nestling feathers of Hoopoes sheds light on one of the possible causes of the decrease in population.

Material and Methods

Three natural nests of the Hoopoe in the farms of Raipur Rayan village in Jullundur district, Punjab, were kept under observation during May 1986. Feathers from the chicks were taken for analysis when the chicks were 7, 21 and 35 days old. In this way, experiments were repeated thrice.

The feathers collected were rinsed thoroughly in distilled water and acetone and dried at 60°C. The feathers of each bird were weighed separately and wet-ashed in a mixture of nitric acid and sulphuric acid with a kjeldahl apparatus. Approximately 40 ml of nitric acid and exactly 1 ml of sulphuric acid were used for ashing a sample. The ashed sample solution was diluted with distilled and deionized water and adjusted to a volume of precisely 50 ml. Lead, zinc and cadmium levels were determined directly from this sample by atomic absorption spectrophotometry, and were calculated per gram of feathers. Students 't' test was employed to test the differences in levels of these elements in the feathers from different age groups of hoopoes.

Results and Discussion

The levels of lead, zinc and cadmium in the feathers from 7, 21, and 35 day old chicks are shown in Table 1. Concentrations of all three elements were observed to have increased rapidly and progressively as the chicks grew older.

Table 1
LEAD, ZINC AND CADMIUM IN THE NESTLING PLUMAGE OF HOOPOE

Age of Nestling (days)	ppm/g feathers* Lead	Zinc	Cadmium
7	300.00*± 50	200.00 ± 20	100.00 ± 20
21	1500.00 ± 100[a]	600.00 ± 100[a]	400.00 ± 100[a]
35	3000.00 ± 200[a]	1000.00 ± 180[a]	700.00 ± 120[a]

*Mean ± S.E. of 3 replications;
[a] = significantly differ at $P < 0.01$ from the corresponding estimation for 7 days nestling.

The larval stages of insects (worms) are dug up by the Hoopoe from the soil of fields for feeding the nestlings. The possible food chain through which the metal pollutants reach the nestlings therefore are the larval stages of insects in the soil. The insect larvae might have accumulated these metals from the soil of fields because of the widespread use of rodenticide zinc phosphide and pesticide lead arsenite for pest management in Punjab. The source of cadmium might be the soil or air or canal water with which many farmers irrigate their fields.

The biological consequences of abnormal intracellular stores of trace elements in animal bodies are unknown. The cells have an intracellular buffer system between zinc and calcium. High zinc content lowers the intracellular calcium level by competition about binding sites (Brewer 1980). Like other trace elements zinc is essential for life but at higher concentrations it is very toxic (Mikas-Davis 1970, Petrie and Row 1977). Individuals who take excessive amounts of supplemented zinc increase their cardiovascular abnormalities (Anderson 1986). Excessive amounts of zinc in the Hoopoe nestlings thus seems to disturbs their vital organs' metabolism. The brain is most vulnerable to lead during early life periods (Stack 1986). Increased placental lead levels have been associated with higher risk of stillbirth and congenital abnormalities in women with occupational histories featuring lead (Wibberly *et al.* 1977). Bryce-Smith *et al.* (1977)

reported very much higher levels of both lead and cadmium in bones from stillbirths than in specimens from neonatal deaths. Lead exposure may affect renal function (Verschoor *et al.* 1986) and haemoglobin synthesis (Nordberg and Nordberg 1986). The delicate nestlings of Hoopoe thus very easily become victims of excessive lead because of the use of pesticides. Cadmium pollution is an increasing problem in industrializing countries. Both airborne and soil borne cadmium are potential sources for uptake into plant materials and animal bodies and affect the metabolism of vital organs such as liver, kidney and reproductive organs.

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16. CETTI'S WARBLER, *CETTIA CETTI*, FROM HARIKE LAKE, PUNJAB

Three individuals of the Cetti's Warbler, *Cettia cetti* were caught during mist netting on 24, 25 and 29 March 1985, along the shores of Harike Lake, Punjab (32°13'N; 75°12'E.). Their biometrics were as follows (in mm):

Wing	Bill	Tarsus	Tail
71	15	23	68
60	15	21	59
60	-	29	58

The birds were trapped along the edge of the lake covered by high grass and reeds and were commonly detected by their clicking noise. They were ringed and released immediately. The HANDBOOK records its distribution as a winter visitor to the plains of the Indus (Peshawar, Bahawalpur and Sind), and possibly Baluchistan. It breeds from Iran and the Caspian Sea, east to Russian Turkestan, winters south to southern Iran and Afghanistan. The species ranges west through the Mediterranean countries to the Iberian Peninsula and Morocco (Ali and Ripley 1983). Hussain (1974) reported its occurrence from Bharatpur, Rajasthan (27°13'N; 77°32'E.), which is the easternmost record for this species. This is the second record of this bird the east of the Indus. Since three specimens were obtained from the same area its occurrence east of the Indus has now been confirmed. Moreover, it has been described as an inveterate skulker (Hussain, *op. cit.*). It is therefore possible that its occurrence in other parts of the country has been overlooked so far.

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SYED ASAD AKHTAR

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